Gas Collection and Control System (GCCS) Design Plan for the White Street Landfill Greensboro, North Carolina

Submitted to:

North Carolina Department of Environment and Natural Resources
Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699

Prepared for:

City of Greensboro
Environmental Services Department
2503 White Street
P.O. Box 3136
Greensboro, North Carolina 27402-3136
(336) 373-7660

Prepared by:

SCS Engineers, P.C.
2520 Whitehall Park Drive, Suite 450
Charlotte, North Carolina 28273
(704) 504-3107

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File No. 02203314.02

Environmental Consultants

2520 Whitehall Park Drive
Suite 450
Charlotte, NC 28273-3557

704 504-3107
FAX 704 504-3174
www.scsengineers.com

SCS ENGINEERS, PC

April 27, 2006
02203314.02

Mr. Booker Pullen
NCDENR – Division of Air Quality
Central Office
1641 Mail Service Center
Raleigh, North Carolina 27699-1641

Subject: REVISED Gas Collection and Control System Design Plan
New Source Performance Standards for Municipal Solid Waste Landfills
White Street Landfill – Greensboro, North Carolina
Facility ID: 4101086

Dear Mr. Pullen:

The City of Greensboro is pleased to submit two copies of the REVISED gas collection and control system (GCCS) design plan for the White Street Landfill. This revised submittal is in response to the EPA letter dated December 14, 2005 from Beverly A. Spagg to Keith Overcash, which stated that the requested variance of excluding Phase I from GCCS requirements was not approved. As a result, the GCCS design plan has been revised to include Phase I. This revised plan is submitted in accordance with the requirements of the federal New Source Performance Standards (NSPS) for municipal solid waste landfills promulgated in 40 CFR Part 60, Subpart WWW and the guidance set forth in the *Enabling Document for the New Source Performance Standards and Emission Guidelines for Municipal Solid Waste Landfills*.

This revised plan is being submitted because the site-wide non-methane organic compound (NMOC) emissions for the site are above 50 megagrams (Mg) per year, as shown in the Tier 2 emission calculations by SCS Engineers, PC, dated August 2, 2004. The scope of this Plan is limited to description, documentation, and certification that the GCCS will meet the requirements set forth in §60.752 - *Standards for Air Emissions from Municipal Solid Waste Landfills* and §60.759 - *Specifications for Active Collection Systems*. Also included are discussions of monitoring and record keeping compliance activities. The plan has been signed and sealed by a North Carolina Professional Engineer.

Please contact Steve Lamb of SCS Engineers, PC at (704) 504-3107, or Greg Dingman of the City of Greensboro at (336) 373-7660 if you have any questions or need additional information.

Sincerely,

Steven C. Lamb, P.E.
Project Director
SCS ENGINEERS, PC

Enclosure

cc: David McNeal – EPA Region 4
Greg Dingman - City of Greensboro Environmental Services Department
Ray Stewart, NCDENR – Winston Salem Office

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CERTIFICATION

I certify that the landfill gas collection and control system as described in this Plan meets the design requirements specified in 40 CFR 60.759 and any alternatives pursuant to 40 CFR 60.752(b)(2). I further certify that this Plan was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of North Carolina.

Project: Gas Collection and Control System Design Plan
White Street Landfill – Greensboro, North Carolina
City of Greensboro, North Carolina

Date

Steven C. Lamb, P.E. No. 28684

SECTION 1

INTRODUCTION

1.1 PURPOSE OF REPORT

This report was prepared by SCS Engineers, PC (SCS) on behalf of the City of Greensboro (City) to fulfill the requirements of the New Source Performance Standards (NSPS), 40 CFR Part 60, Subpart WWW, for a Gas Collection and Control System (GCCS) Design Plan "Plan" for White Street Landfill (Landfill). The Landfill is located in Greensboro, North Carolina in Guilford County and is owned and operated by the City. The site is regulated under the NSPS, and is required to address landfill gas (LFG) collection and control due to its design capacity exceeding 2.5 million megagrams (Mg), and its Tier 2 non-methane organic compounds (NMOC) annual emission rate, which was calculated to exceed 50 Mg per year.

1.1.1 Site Background Information

The facility (Solid Waste Permit No. 41-03) encompasses an area of approximately 767 acres in the northeast quadrant of the City, at the east end of White Street. The Landfill is used for the disposal of waste generated within the City and Guilford County. Beginning in 1943, waste handling at the Landfill consisted primarily of incineration. Burning operations ceased in 1965, and since that time refuse has been landfilled on site.

The Landfill consists of three distinct municipal solid waste (MSW) landfill areas designated as Phase I, Phase II and Phase III. Phase I is the oldest of the three areas. It is approximately 65 acres in size and contains land clearing and inert debris (LCID) deposited on top of MSW. This phase was filled with MSW between the years 1965 and 1978 and contains approximately 3.0 million tons of MSW. In addition, the City disposed of LCID on top of the MSW from 1999 to 2004. There is approximately 20 to 25 feet of LCID on top of the MSW.

Phase II is an unlined, 145-acre area that received approximately 5.4 million tons of MSW from 1978 to 1997. In addition, in 1998 the City began depositing construction and demolition (C&D) debris on top of portions of MSW in Phase II and is currently continuing this disposal.

Phase III, a Subtitle-D lined, 52-acre area, began receiving waste in 1997. Phase III consists of three cells. Cell 1 is approximately 25 acres in size, Cell 2 is approximately 15 acres in size and Cell 3 is approximately 12 acres in size and is the current active MSW portion of the Landfill.

1.1.2 GCCS Plan Submittal

The following Plan fulfills the requirements of a NSPS GCCS Design Plan, as set forth in 40 CFR §60.752 and §60.759, as described herein (referred to hereafter as §60.752 and §60.759). The scope of this Plan is limited to description, documentation, and certification that the GCCS will meet the requirements set forth in §60.752 - *Standards for Air Emissions from Municipal Solid Waste Landfills* and §60.759 - *Specifications for Active Collection Systems*. This Plan was developed in accordance with the NSPS and the guidance set forth in the *Enabling Document for the New Source Performance Standards and Emission Guidelines for Municipal Solid Waste Landfills*.

As required by the NSPS, the Plan addresses those areas defined as active areas where the first refuse deposited in the area has reached an age of five years or more or those areas closed or at final grade where the first refuse deposited in the areas has reached an age of two years or more (§60.752(b)(2)(ii)(A)).

This Plan is organized into five sections:

- Section 1 - Introduction
- Section 2 - Landfill Gas Collection and Control System
- Section 3 - Future Site Development
- Section 4 - Compliance Review and Evaluation
- Section 5 - Requested Alternative Monitoring/Recordkeeping/Recording Procedures

Information presented in this Plan was compiled from review of Landfill information provided to SCS by the City, review of available construction phasing, record drawings, design documentation and calculations for the GCCS design, and discussions with City personnel.

1.2 COMPLIANCE SUMMARY TABLE

A summary of the compliance requirements and project-specific conditions is presented in Table 1-1.

TABLE 1-1. REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.752(b)(2)	Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year of the calculated NMOC emission rate equaling or exceeding 50 Mg per year.	This Plan fulfills this requirement.	
§60.752(b)(2)(i)(A)	The collection and control system as described in this plan shall meet the design requirements of paragraph (b)(2)(ii) of this section.	As presented in this Plan, the proposed system meets the design requirements.	
§60.752(b)(2)(i)(B)	The collection and control system design plan shall include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, record keeping, or reporting provisions of §60.753 through §60.758 as proposed by the owner or operator.	The City of Greensboro requests alternatives that are specified in Section 5.	
§60.752(b)(2)(i)(C)	The collection and control system design plan shall either conform to specifications for active collection systems in §60.759, or include a demonstration to the Administrator's satisfaction of the sufficiency of alternative provisions under §60.759.	As presented in this Plan, the proposed system meets the design requirements, as will be confirmed during future surface emissions testing.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.752(b)(2)(i)(D)	The Administrator shall review the information submitted under this section, and either approve it, disapprove it, or request that additional information be submitted. Because of the many site-specific factors involved with LFG system design, alternative systems may be necessary. A wide variety of system designs are possible such as vertical wells, combination horizontal and vertical collection systems, or horizontal trenches only, leachate collection components, and passive systems.	Information required for review is presented within this Plan.	
§60.752(b)(2)(ii)	Install a collection and control system within 18 months of the submittal of the design plan that effectively captures the gas generated within the landfill.	The proposed collection and control system includes the existing system as well as any needed upgrades. The system will collect gas from all areas of the landfill that conform to the 2- or 5-year control-required criteria set forth in the NSPS. Future expansion of the GCCS will be performed in accordance with the scheduling requirements set forth in the NSPS or an approved alternative schedule.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.752(b)(2)(ii)(A)(1)	An active collection system shall be designed to handle the maximum expected flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment.	The proposed header system is designed to handle the maximum flow for the GCCS, as estimated from U.S. EPA's landfill gas emission models (LandGEM) in Section 4.1.3.	
§60.752(b)(2)(ii)(A)(2)	The GCCS shall collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active, or 2 years or more if closed or at final grade.	Collection will occur in areas meeting the 2- or 5-year collection-required criteria unless an alternative schedule is approved. Future expansion of the GCCS will be performed in accordance with scheduling requirements set forth in the NSPS or an approved alternative schedule.	
§60.752(b)(2)(ii)(A)(3)	The GCCS shall collect gas at a sufficient extraction rate.	Landfill gas will be collected at a sufficient rate, as will be confirmed during future surface emissions monitoring of inactive areas of the landfill. Rates of collection may be modified based upon results of surface emissions monitoring.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.752(b)(2)(ii)(A)(4)	The GCCS shall be designed to minimize off-site migration of subsurface gas.	The GCCS is designed to minimize off-site migration of subsurface gas by reducing gas pressures within the landfill.	
§60.752(b)(2)(iii)(A)	All collected gas shall be routed to an open flare designed and operated in accordance with §60.18.	Currently, all collected landfill gas will be either conveyed to the existing open flares operated in accordance with §60.18 or treated and piped offsite for utilization by the LFG-to-energy end user.	
§60.752(b)(2)(iii)(B)	All collected gas shall be routed to a control system designed and operated to reduce NMOC by 98 percent weight, or when an enclosed combustion device is used for control, to either reduce NMOC by 98 percent weight or to reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane, at 3 percent oxygen. The reduction efficiency or parts per million by volume shall be established by an initial performance test, required under §60.8, using the test methods specified in §60.754(d).	The open flares are designed to meet the 98 percent by weight reduction of NMOC. An initial performance test will be conducted on these open flares to establish the reduction efficiency.	
§60.752(b)(2)(iii)(C)	Route the collected gas to a treatment system that processes the collected gas for subsequent sale or use. All emissions from any atmospheric vents from the gas treatment system shall be subject to the requirements of (b)(2)(iii)(A) or (B) of this section.	Currently, all collected landfill gas will be either conveyed to the existing open flares or treated and piped offsite for utilization by the LFG-to-energy end user.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.759(a)(1)	Collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer.	Collection devices will provide comprehensive control of surface emissions, as will be confirmed by future surface emissions monitoring. This Plan has been signed and sealed by a Professional Engineer registered in North Carolina.	
§60.759(a)(1)	The following issues shall be addressed in the design: depth of refuse, refuse gas generation rates, flow characteristics, cover properties, gas system expandability, leachate management, condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat.	All applicable issues were addressed in the design, and are discussed in Section 4 of this Plan.	
§60.759(a)(2)	Gas collection devices shall be installed in sufficient density to address landfill gas migration issues and augmentation of the collection system through use of active or passive systems at the landfill perimeter or exterior.	Gas collection devices will be installed at a sufficient density to facilitate control, as will be confirmed by future surface emissions monitoring.	
§60.759(a)(3)	Placement of gas collection devices shall control all gas producing areas, except those from asbestos, non-degradable, and non-productive areas of the landfill.	Gas will be controlled in all regulatory-required gas-producing areas of the landfill.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.759(a)(3)(i)	Segregated areas of asbestos or non-degradable material may be excluded from collection if sufficiently documented.	The C&D portions of Phase II are excluded from collection based on non-degradable material.	
§60.759(a)(3)(ii)	Any non-productive areas of the landfill may be excluded from control, provided excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill.	There are no proposed areas of the landfill to be excluded from control based on non-productivity.	
§60.759(b)(1)	LFG extraction components shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other non-porous corrosion-resistant material.	The GCCS will be constructed of non-porous, corrosive resistant materials, mostly PVC and HDPE, as described in Sections 2 and 4.4, and the response to §60.759(b)(3) on Page 1-12.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.759(b)(1)	Dimensions of gas extraction components shall be sufficient to convey projected amounts of gas; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads.	The GCCS design is sized sufficiently to convey the projected amount of gas for the system. Future modifications to the GCCS design will be made as required to accommodate collection of gas from future waste disposal operations. Adequacy of the current system will be confirmed during future surface emissions monitoring. The system components are consistent with the "state-of-the-practice" for modern GCCS designs and can withstand the installation and operational stresses placed on the components.	
§60.759(b)(1)	The collection system shall extend as necessary to comply with the emission and migration standards.	The GCCS will be expanded as necessary to conform to emission standards set forth in the NSPS. Future expansion of the GCCS will be performed in accordance with scheduling requirements set forth in the NSPS or an approved alternative schedule. Adequacy of the existing system will be confirmed during future surface emissions monitoring.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.759(b)(1)	Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control.	Collection wells are perforated so as not to increase head loss, in accordance with current "state-of-the-practice" methods.	
§60.759(b)(1)	Perforations shall be situated with regard to the need to prevent excessive air infiltration.	Perforated gas collection piping is designed to minimize air infiltration as described in Section 2.	
§60.759(b)(2)	Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill.	Proposed future vertical extraction wells will be installed with the bottom of the borehole at least 10 feet above the estimated bottom of refuse so as not to endanger the underlying liner system in Phase III. Also, vertical extraction wells can be fitted with pumps for liquid removal from the well, if necessary.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.759(b)(2)	Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-sectional area so as to allow for their proper construction and completion including the centering of pipes and placement of gravel backfill.	As is the case with the existing wells, future wells will be installed in 24- or 36-inch diameter boreholes, which are sufficient for proper installation of well casings and backfill materials. All existing and future holes and trenches for piped wells and horizontal collectors were and will be of sufficient cross-sectional area so as to allow for their proper construction and completion including the centering of pipes and placement of gravel backfill.	
§60.759(b)(2)	Collection devices shall be designed so as not to allow indirect short-circuiting of air into the cover or refuse into the collection system or gas into the air.	Wells will be designed to prohibit short-circuiting of air into cover or refuse.	
§60.759(b)(2)	Any gravel used around pipe perforations shall be of sufficient dimension so as not to penetrate or block perforations.	Gravel used for backfill will be of sufficient size to not penetrate or block perforations.	

**TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA**

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.759(b)(3)	Collection devices may be connected to the collection header pipes below or above the landfill surface.	Both above and below grade header may be used for the GCCS, though the current system design employs below grade piping only. Collection devices will be connected to the header system as shown on the drawings (Appendix A).	
§60.759(b)(3)	The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings, and at least one sampling port.	Wells will incorporate a control valve, sampling ports, and a means to access the well via an access port or removable cap.	
§60.759(b)(3)	Collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other non-porous material of suitable thickness.	The system is constructed of "state-of-the-practice" materials, with proven performance in landfills across the United States. Future wells will be constructed of PVC or HDPE pipe, laterals and collection headers will be constructed of HDPE, and the valves will be constructed of PVC.	

TABLE 1-1. (CONTINUED) REGULATORY COMPLIANCE CHECKLIST
WHITE STREET LANDFILL – GREENSBORO, NORTH CAROLINA

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.759(c)	The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment.	The gas moving system is designed to handle the maximum flow rate derived from the U.S. EPA LandGEM for the GCCS service area. Modifications to the system may be required to accommodate collection of gas from waste disposed in the future.	
§60.759(c)(1)	For existing gas collection systems, existing flow data shall be used to project the maximum flow rate. If no flow data exists, procedures delineated in the item below shall be used.	Existing flow data was compared to the LFG recovery rates projected by the models, for the purpose of sizing collection pipes and locating extraction wells.	
§60.759(c)(2)	For new collection systems, the maximum flow rate shall be in accordance with the methods specified in §60.755(a)(1).	The maximum flow for evaluating the existing system was derived from the U.S. EPA LandGEM using AP-42 default parameters. See Section 4.1.3.	

SECTION 2

LANDFILL GAS COLLECTION AND CONTROL SYSTEM

This section presents a description of the NSPS-compliant GCCS for Phases I, II and III.

2.1 PHASE I GCCS

As described earlier, White Street Landfill consists of three separate waste disposal areas, or phases. Phase I stopped receiving MSW in 1978 and currently does not have a landfill gas (LFG) collection system.

To meet NSPS requirements, vertical extraction wells and associated piping and condensate collection devices are proposed to actively collect LFG from Phase I, as shown on Drawing 4, Appendix A.

Each vertical extraction well will include a wellhead constructed of appropriate materials, such as SCH 80 PVC. Wellheads will include a valve for flow control and monitoring ports for measuring gas quality, temperature, and flow rate.

The proposed header system is adequate to collect expected LFG flows associated with Phase I and will be tied into the existing header system from Phase II. As stated above, Phase I is the oldest area at White Street Landfill, with MSW last placed there in 1978. Therefore, expected LFG flow in this phase is fairly limited according to the EPA LandGEM model with a steady decline in future years. As such, the header pipe is sized smaller than what is normally seen for a LFG header size.

2.2 PHASE II GCCS

Phase II has an existing, comprehensive active LFG extraction system that was installed and is operated by Duke Engineering and Services (DES). LFG from Phase II is collected and either treated and conveyed to Cone Mills via a 3.5 mile transmission pipeline in accordance with §60.752(b)(2)(iii), or flared at the Phase II blower/flare station. Typically, the pipeline carries approximately 1,400 to 1,600 scfm of LFG from Phase II. At this time, the flare serves as a backup control device and is designed to provide the LFG destruction efficiency required by §60.752(b)(2)(iii) of the NSPS. See Drawing 2 in Appendix A for the GCCS in Phase II.

Currently, 84 vertical extraction wells are utilized in Phase II. Extraction wells in this phase typically extend to a depth equal to the landfill depth at each well location. Wells installed in Phase II vary from approximately 26 to 80 feet deep. Based on engineering experience, SCS estimates that the effective radius of influence of the vertical extraction wells will be approximately 2 times the well depth. Therefore, a well depth of 30 feet corresponds to an expected radius of influence of approximately 60 feet. The well spacing in Phase II varies from

100 to 300 feet, depending on the projected radii of influence.

Wells installed in Phase II were constructed of Schedule (SCH) 80 PVC pipe installed in a 30-inch or 36-inch diameter borehole. Future LFG extraction wells, if necessary, will also be installed in 30-inch or 36-inch diameter boreholes. The extraction piping will be either HDPE SDR 17 or SCH 80 PVC pipe. Typically, the lower two-thirds of the well pipe will be perforated. Perforations typically will be either 1/2-inch diameter holes spaced at 16 holes per foot, or 3/8-inch wide by 8-inch long slots spaced at approximately four slots per foot. However, alternative slot or perforation designs, which provide comparable performance, may be considered.

Each extraction well includes a wellhead constructed of appropriate materials, such as SCH 80 PVC. Each wellhead includes a valve for flow control and monitoring ports for measuring gas quality and temperature.

2.3 PHASE III GCCS

Phase III currently contains 15 horizontal collectors that actively convey LFG to a blower/flare station, where the LFG is either treated and conveyed to the Cone Mills pipeline via a 12-inch pipeline in accordance with §60.752(b)(2)(iii), or flared at the Phase III blower/flare station. Currently about 800 scfm is transmitted to the Cone Mills pipeline and the Phase III utility flare burns the rest. The utility flare is designed to provide the LFG destruction efficiency required by §60.752(b)(2)(iii) of the NSPS. See Drawing 3 in Appendix A for the existing GCCS in Phase III.

To meet the NSPS requirements, additional horizontal collectors and vertical LFG extraction wells are proposed to actively collect LFG from Phase III, as shown on Drawing 5, Appendix A. Three tiers of horizontal collectors are proposed at final buildout, corresponding with the benches proposed for Phase III, at elevations 790 feet, 830 feet, and 870 feet. Typically, horizontal collectors will continue to be used in the interior of the waste mass in areas that are at least 5 years old. Vertical extraction wells will be used to collect LFG on the landfill's sideslopes where horizontal collectors are not as effective.

To maintain full collection system coverage within the interior of the landfill, horizontal collectors likely would be spaced approximately 150 feet apart, which corresponds to a zone of influence of approximately 75 feet. Collector length will vary depending on site conditions at the time of system expansion.

If used, horizontal collectors will be constructed to include the following features:

- Collector pipe will be 4- or 6-inch diameter HDPE with a standard dimension ratio (SDR) of 17 or corrugated HDPE pipe with a smooth interior with sufficient strength to resist crushing force due to the overburden of the landfill.

- The perforated collector pipe will be installed in a trench filled with appropriate aggregate material such as rock or chipped tires. The aggregate will be sized so as to not pose significant risk of clogging the pipe perforations.

- Perforated pipe will cease at least 50 feet inward from the end of the collector. The remaining length of collector will be solid-wall pipe. This will reduce the potential for air infiltration into the collectors.

- Perforations in the pipe will be sufficiently large enough to not cause excessive head loss detrimental to LFG collection. Typical perforations will be 1/2 inch in diameter.

Each extraction well or horizontal collector will include a wellhead constructed of appropriate materials, such as SCH 80 PVC. Wellheads will include a valve for flow control and monitoring ports for measuring gas quality, temperature, and flow rate.

The header system currently in place in Phase III is constructed so that future expansion of the system can be accommodated. Future headers will also be constructed in this manner. This includes sizing the header to be compatible with the future flow rates expected during the life of the initial system components.

Note that the future expansion drawings included with this Plan are conceptual in nature. The exact locations and construction of any new wells will be determined during future design phases, and may be subject to relocation due to site conditions or filling operations.

2.4 HEADER AND LATERAL COLLECTION PIPING

The header and lateral collection piping will be constructed of fusion-welded HDPE SDR 17 pipe. Header and laterals in the landfill may be installed either below or above grade. If used, above grade header and laterals will be anchored as appropriate.

The header system will be sized to handle the maximum projected current and future flow rates over the useable life of the system. The header size will typically vary from 12 to 16 inches in diameter. Laterals typically will be 4 or 6-inch diameter. The criteria considered in sizing of header piping include:

- **Unit Header Loss** - Head losses in any given section of piping will be standardized to 100-foot sections with a maximum allowable head loss of one inch of water column (in-wc).

- **Gas Velocity** - In general, design gas velocities will not exceed 2,400 feet per minute (fpm).

- **Worst Case Analysis** - The loop configuration present in the current configuration as well as the final system build-out will allow gas to flow in multiple directions.

- **Future Expansion** - Header piping will include blind flanges for system expansion into future landfill phases, or will be buried to a depth shallow enough to allow for tie-ins using electrofusion couplings.

2.5 HEADER ISOLATION VALVES

In order to allow for isolation of certain sections of header in case of the need to perform repairs without shutting down the entire system, header isolation valves may be installed. These valves will be constructed of corrosion resistant materials such as PVC, and all metal parts potentially exposed to LFG will be coated with enamel or similar coatings to increase corrosion resistance. Both the seals and valve bodies will be appropriate for the specified application.

2.6 CONDENSATE PRODUCTION AND MANAGEMENT

In general, LFG condensate will be collected and routed to onsite storage tanks, the leachate collection system, or will drain via gravity into condensate traps located at low points in the GCCS piping. These traps will drain condensate into aggregate backfill surrounding the trap thereby allowing condensate to drain into the existing refuse.

Condensate which accumulates in the GCCS piping located outside of the waste footprint, in non-Subtitle D phases of the landfill, or at the blower/flare station will drain via gravity to sumps installed at low points in the GCCS piping. These sumps are equipped with pumps. These sumps will store and pump the collected condensate into the leachate collection system via a cleanout riser pipe. The proposed condensate trap and sump locations are shown on the drawings in Appendix A. These locations are conceptual and may change due to actual field conditions and future landfilling operations.

2.7 BLOWER/FLARE STATION

2.7.1 Phases I and II Blower/Flare Station

The specifications for the existing blower/flare station at Phase II, which will also be used for Phase I LFG, are as follows:

- Two centrifugal blowers (1,400 scfm at 35 inches of water column "w.c");

- The two blowers are connected in parallel. Each blower is manufactured by Hoffman, one has a 125-horsepower (hp) motor and the other has a 150-hp motor. The blowers are designed to provide a wide range of flows and long-term service.

- A moisture separator/filter to maximize condensate removal upstream of the blower to minimize corrosion.

- An actuator valve to shut off flow of LFG to the flare during shutdown and prevent free venting of LFG to the atmosphere.

- The flare is designed to provide a minimum non-methane organic compound (NMOC) destruction efficiency of 98 percent. The flare is designed and operated in accordance with §60.18. The flare is manufactured by LFG Specialties, Inc. and is designed to handle a flow rate of at least 2,800 scfm, which is greater than the maximum projected LFG generation rate of approximately 2,600 cfm in 2005.

The City is also evaluating adding new dewatering equipment downstream of the blower sufficient to remove moisture in accordance with 60.752(b)(2)(iii)(C) and the NSPS definition of gas "treatment" for LFG entering the LFG transmission pipeline.

2.7.2 <u>Phase III Blower/Flare Station</u>

The specifications for the existing blower/flare station at Phase III are as follows:

- Two positive displacement blowers (1,500 scfm at 45 inches of water column "w.c").

- The 45 hp blower is manufactured by Tuthill.

- A moisture separator/filter to maximize condensate removal upstream of the blower to minimize corrosion.

- Dewatering equipment downstream of the blower sufficient to remove moisture in accordance with 60.752(b)(2)(iii)(C) and the NSPS definition of gas "treatment".

- An actuator valve to shut off flow of LFG to the blower during shutdown.

- The flare is designed to provide a minimum non-methane organic compound (NMOC) destruction efficiency of 98 percent. The flare is designed and operate in accordance with §60.18. The flare is manufactured by LFG+E and is designed to handle a flow rate of at least 1,500 scfm.

2.7.3 <u>Blower/Flare Controls</u>

The controls at the blower/flare stations include:

- Programmable logic controller (PLC).

- Landfill gas flow meter.

- Blower and flare controls interface for automatic motor starting following pilot ignition.

- Alarm indicators for high temperature, low temperature, flame failure, pilot failure, inlet valve failure, and blower failure.

SECTION 3

FUTURE SITE DEVELOPMENT

3.1 LANDFILL DEVELOPMENT PLAN

The Landfill is projected to have a final MSW disposal area of approximately 262 acres. Phases I and II are closed and Phase III is currently active.

It is assumed that the more durable LFG system components such as header, laterals, wells, sumps, and blowers will have a maximum life of approximately 15 years. After that length of time, it often becomes necessary to perform maintenance or to replace some of these components. It is intended that future LFG system designs will incorporate similar engineering judgment and methods as explained in this Plan.

3.2 GAS SYSTEM EXPANSION CAPABILITIES

While the specific layout of future LFG system components needed beyond the 15-year reasonable life of the initial system are not decided at this point, the proposed GCCS is designed to accommodate expansion of the system into future landfill areas. These considerations include appropriate header and condensate trap/sump sizing, additional blower and flare capacity incorporated into the proposed units, and blind flanges for connection to the expansion areas. Header and condensate traps/sumps were sized based on the projected LFG recovery rates from the current and proposed landfill areas based on projected future waste burial rates.

SECTION 4

COMPLIANCE REVIEW AND EVALUATION

The purpose of this Section is to describe and document information required to certify compliance of the GCCS with the applicable sections of 40 CFR 60.759 - *Specifications for Active Collection Systems*, including:

- §60.759(a) - Compliance with §60.752(b)(2)(i).
- §60.759(b) - Construction procedures.
- §60.759(c) - Conveyance of LFG in compliance with §60.759(b)(2)(iii).

Additionally, portions of §60.755 - *Compliance Provisions* relevant to GCCS specifications are addressed, including:

- §60.755(a)(1) - Calculations for maximum expected gas generation flow rate.
- §60.755(a)(2) - Sufficient density of gas collectors.
- §60.755(a)(3) - Collection system flow rate sufficiency.
- §60.755(a)(5) - Identification of excess air infiltration.

4.1 COMPLIANCE WITH §60.759(a)(1)

The following sections address compliance with the applicable sections of §60.759(a)(1).

4.1.1 Control of Surface Emissions

The current and proposed GCCS for the Landfill is designed to minimize surface emissions. The proposed surface emissions monitoring routes for Phase I is shown in Figure 4-1 and for Phase II is depicted on Figure 4-2. The current surface emissions monitoring route for Phase III and the final route following closure of Phase III are shown on Figures 4-3 and 4-4, respectively.

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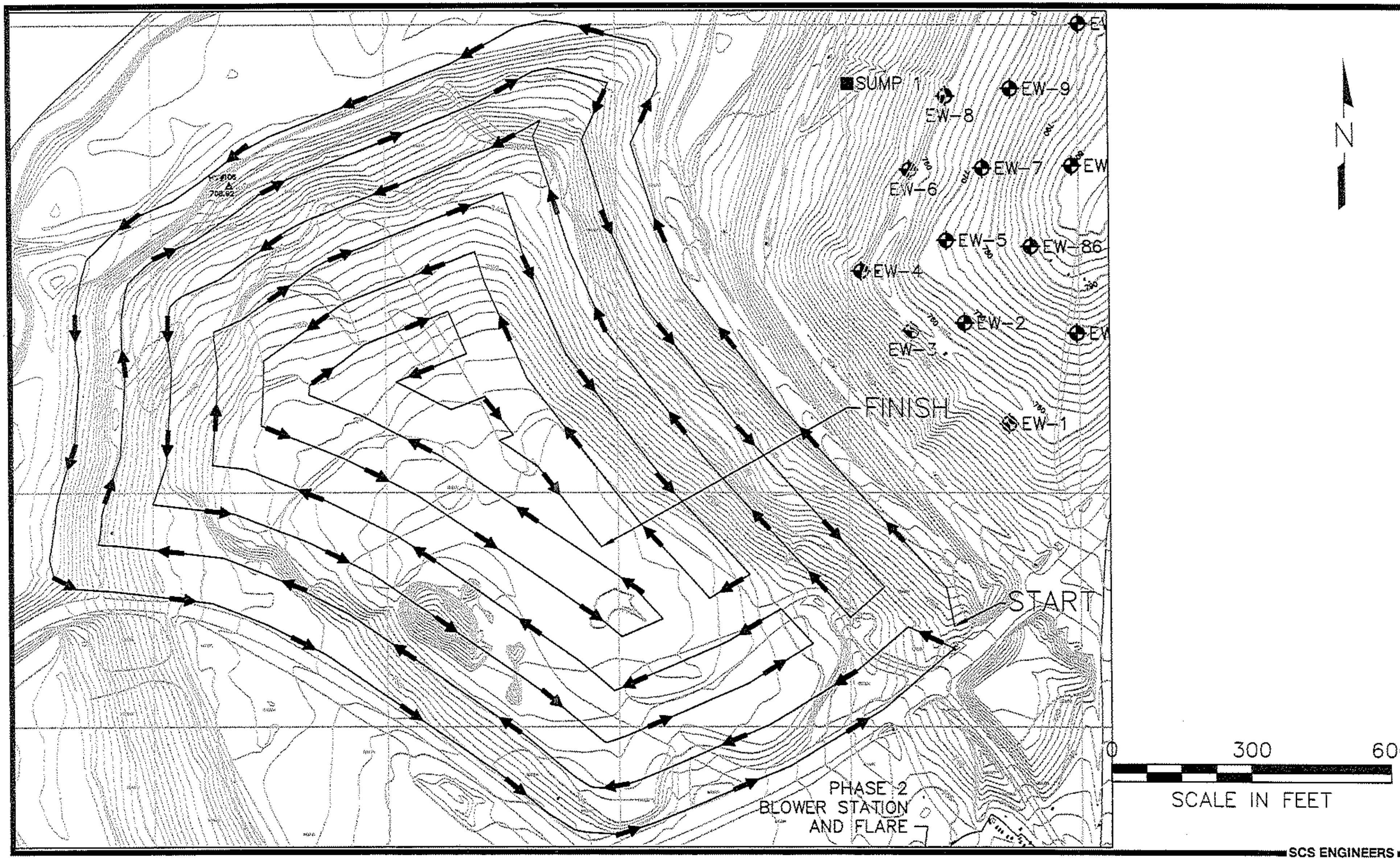

FIGURE 4-1 SURFACE EMISSION ROUTE FOR PHASE 1

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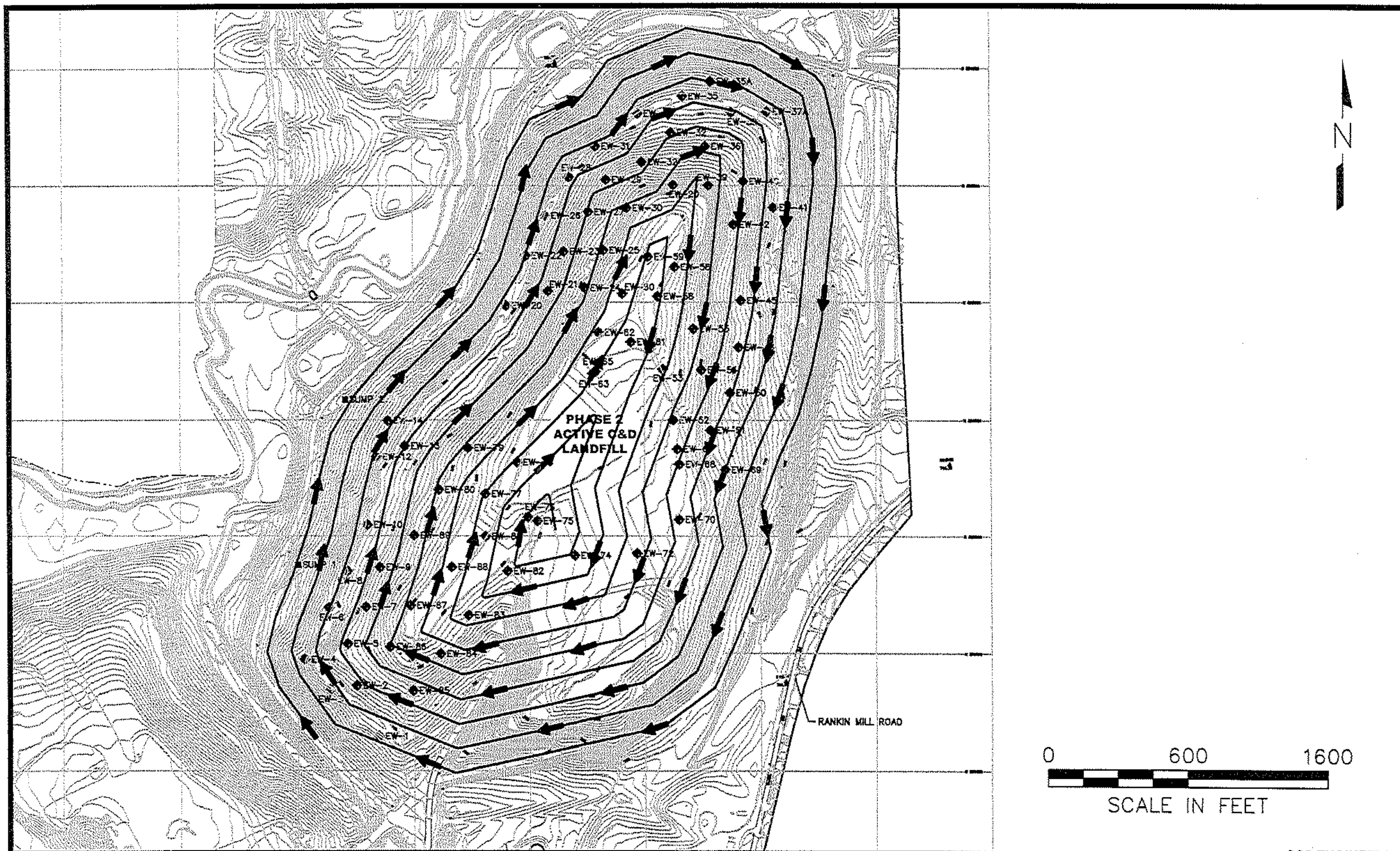

FIGURE 4-2 SURFACE EMISSION ROUTE FOR PHASE 2

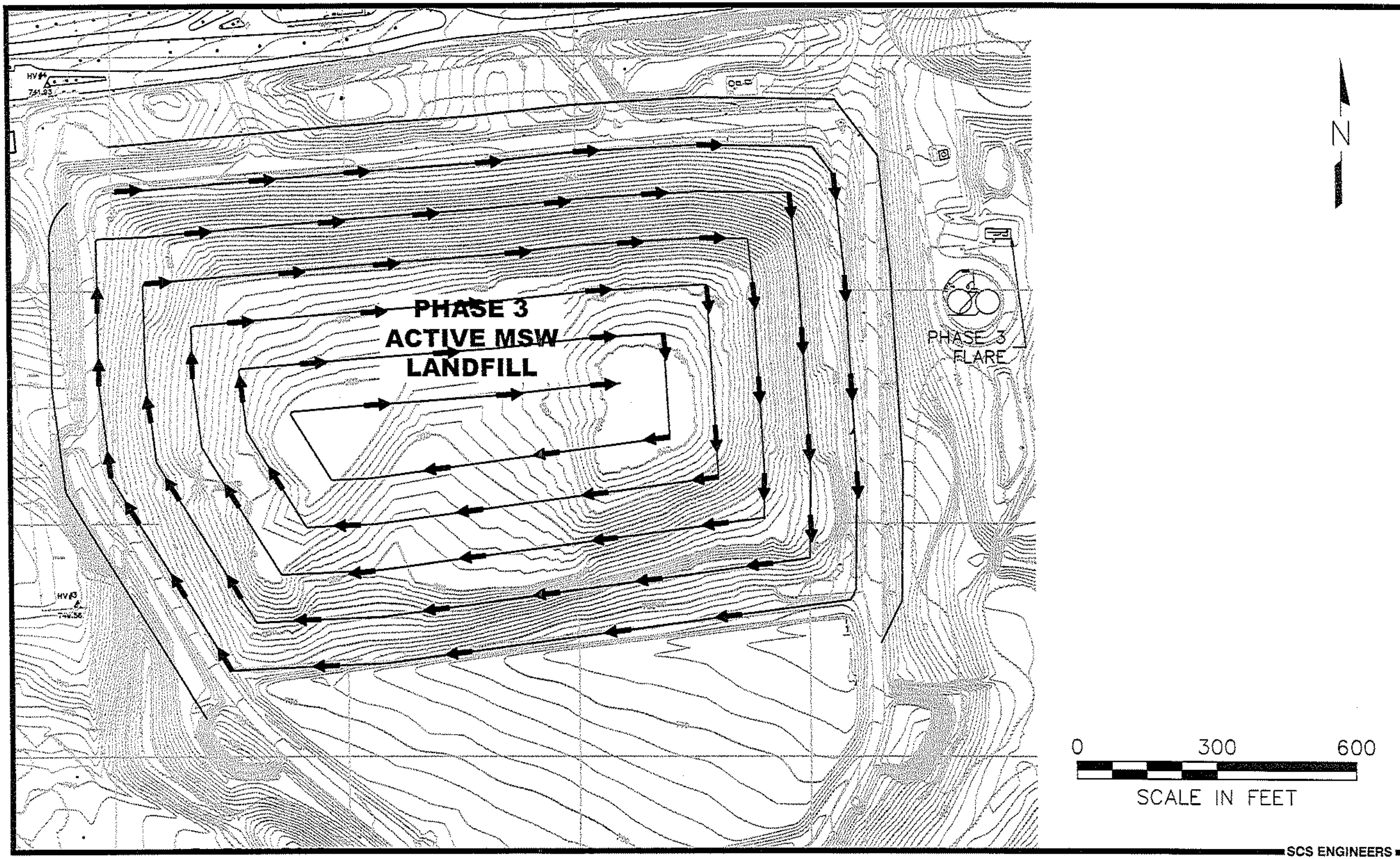

FIGURE 4-3: SURFACE EMISSION ROUTE FOR PHASE 3A

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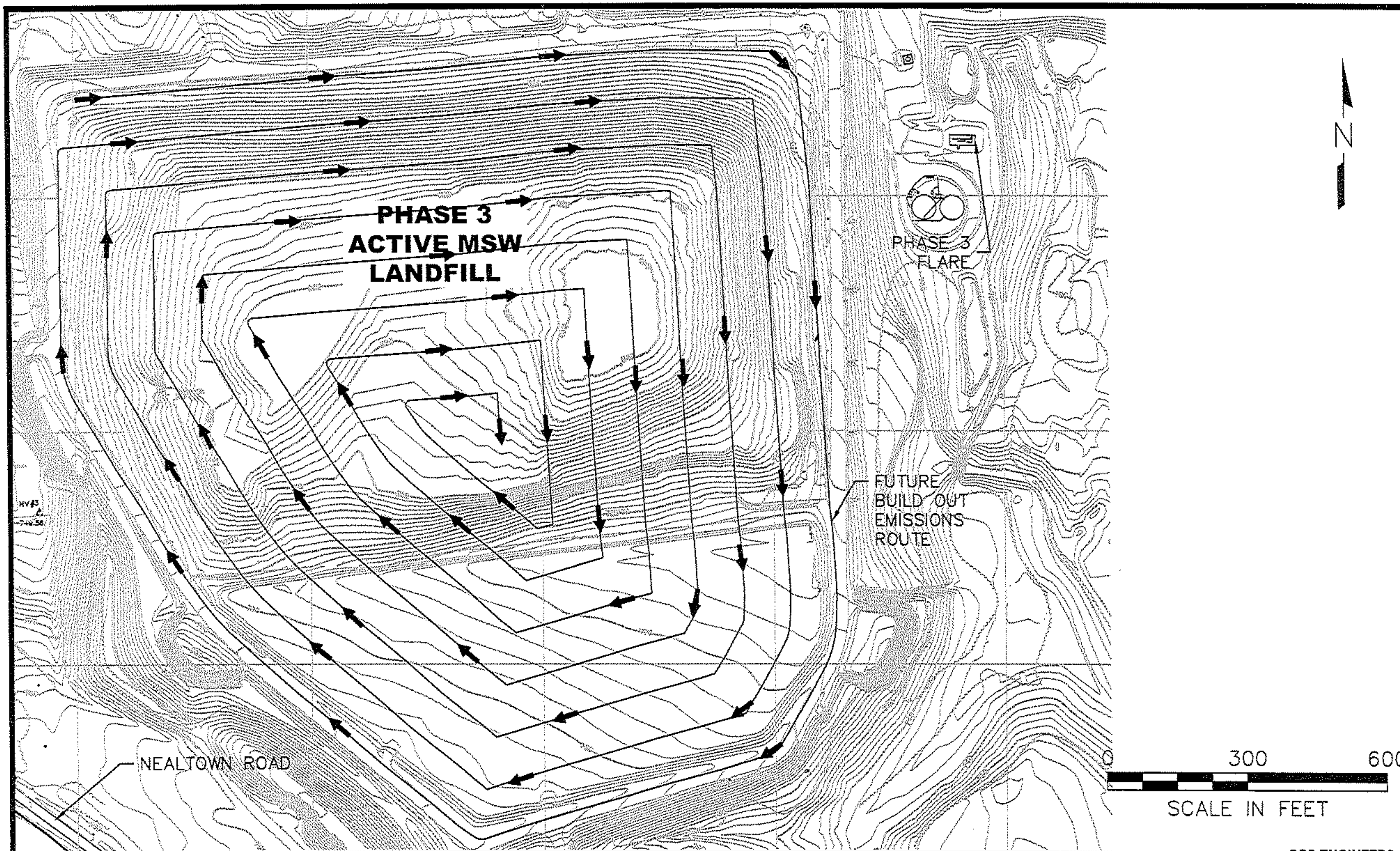

FIGURE 4-4: SURFACE EMISSION ROUTE FOR PHASE 3 (FINAL BUILD OUT)

4.1.2 Depths of Refuse

The depth of refuse in the three phases varies. The depth of refuse in Phase I is approximately 35 feet. The depth of refuse in Phase II varies from 26 to 80 feet. The depth of refuse in Phase III when closed will range from 50 to 180 feet.

4.1.3 Refuse Gas Generation Rates and Flow Characteristics

Landfill gas modeling was performed for Phases I, II, and III to estimate the LFG generation rate for the landfill. Modeling was performed using the U.S. EPA's Landfill Gas Emissions Model (LandGem), with the U.S. EPA's AP-42 default values and a site-specific NMOC concentration for each of the three phases input to the models. Waste tonnages used in the models were taken from the recent NSPS Tier 2 report. A copy of the model outputs (which includes the assumptions used in the models) is provided in Appendix B.

As shown in Table B-1 (Appendix B), the maximum projected LFG generation rate in Phase I occurred in 1978 and has steadily declined to a projected LFG generation rate of approximately 625 scfm in year 2005.

As shown in Table B-2 (Appendix B), the maximum projected LFG generation rate in Phase II occurred in 1998. The model predicts the LFG generation rate in 2005 to be approximately 2,600 scfm. Assuming a 75 percent collection efficiency for the current Phase II GCCS, a LFG collection rate of approximately 1,950 scfm is expected in 2005.

As shown in Table B-3 (Appendix B), the maximum projected LFG generation rate for the Phase III is approximately 1,700 scfm in year 2008. Assuming a 75 percent collection efficiency for the current system, a LFG collection rate of approximately 1,250 scfm is expected in 2008.

4.1.4 Landfill Cover Properties

The final cover system for Phases I and II includes the following components, from top to bottom:

- Vegetative layer,
- 6-inch erosion layer, and
- 18-inch barrier soil layer.

Areas currently at interim grade are covered with 12 inches of cover soil, plus the daily cover. These cap conditions are factored into the design of the LFG collectors and wells in order to minimize the potential for pulling ambient air into the landfill.

The final cover system for Phase III will be in accordance with state regulations and will generally include, from top to bottom:

- Vegetative layer,
- Erosion layer,
- Flexible membrane liner, and
- Barrier soil layer.

4.1.5 Gas System Expandability

Expandability of the GCCS is achieved by installing blind flanges along header and lateral piping, which allows the LFG piping to be easily expanded in the future. In the event that actual LFG flow rates exceed the capacity of the existing gas moving equipment, additional GCCS components will be designed and installed to accommodate the increase.

4.1.6 Leachate and Condensate Management

Phases I and II are unlined landfills and do not have a leachate collection system. Condensate management in the Phases I and II GCCS is accomplished through the use of sumps and pneumatic pumps which convey LFG condensate to the existing leachate storage tank.

Phase III has a composite liner system with a leachate collection layer. Leachate collection sumps within the landfill are equipped with submersible pumps that remove leachate to the on-site leachate storage tanks.

4.1.7 Accessibility

Site access is provided by paved and unpaved access roads. Future access will be provided by access roads as needed.

4.1.8 Compatibility with Filling

To avoid the need to raise wells as filling occurs, the design of the initial phases of the GCCS primarily employs horizontal collectors in the active Phase III. While this is true for most of the wells, in order to provide collection system coverage to all parts of the landfill, some future vertical wells may be installed in areas that will receive additional waste. In some cases, it is feasible to extend a well as filling occurs. Past experience at sites across the U.S. shows that it is not unreasonable to raise wells 20 to 30 feet in active areas and still maintain adequate LFG collection rates.

For GCCS components installed in areas not filled to final grade, the City will protect exposed wellheads and piping during subsequent filling activities. Concrete bollards may be installed around sumps, etc. to provide protection from traffic or other damage.

4.1.9 Integration with Closure End Use

At landfill closure, the closure plan will address any integration of the LFG system with the intended end use.

4.1.10 Air Intrusion Control

Air intrusion control for the GCCS will be provided by the engineered final cover system installed over areas filled to final grade. Air intrusion control also will be provided by the extraction well design, in as much as the slotted pipe in vertical wells is set no closer than 15 feet of ground surface. The City will conduct wellfield tuning to reduce the oxygen and nitrogen content of the LFG to a level at or below the regulatory limits of 5 percent oxygen or 20 percent nitrogen. Oxygen and nitrogen levels will be reduced (as necessary) by reducing the vacuum placed on individual wells.

Air intrusion control in future years will be accomplished by the final cover system after completion of filling in the individual areas and by proper tuning of the wellfields during operation of the GCCS.

The City likely will use an instrument such as the Landtec GEM-500, Landtec GEM-2000, or equal, to meet the equipment requirements set forth in §60.753(c)(2) for field measurement of oxygen. The GEM-500 and GEM-2000 are suitable for the Method 3A testing prescribed for measuring wellfield performance. In the event the GEM-500, GEM-2000 or equal does not conform precisely to the rule, White Street Landfill requests a variance to the rule to allow the use of the GEM-500, GEM-2000 or equal for measurement of wellfield performance. This is consistent with past positions taken by U.S. EPA.

4.1.11 Corrosion Resistance

In general, the system components described in Section 2 of this report represent "state-of-the-practice" materials, and have proven to be resistant to corrosion with proper installation, operation, and maintenance in GCCS applications across the United States.

4.1.12 Fill Settlement

Settlement or subsidence of waste fill can affect a GCCS in numerous ways, including:

- Damage or destruction of below grade header and lateral piping systems.
- Blockage of header and lateral piping systems, as a result of condensate collecting in the piping (at locations where the elevation of the top of the pipe drops below the elevation of the bottom of the pipe due to settlement), thereby blocking the flow of gas.

- Damage, displacement, or destruction of well casings, seals, and filter materials, as a result of settlement in the landfill mass adjacent to the well.

Components or features incorporated into the existing GCCS design to address potential effects of settlement include:

- Installation of below grade laterals and headers with a minimum 2 percent slope, thereby providing allowance for some settlement without damage or blockage of the piping systems.

- Use of fusion-welded HDPE piping for the headers and laterals. Fusion-welded HDPE pipe is less susceptible than PVC pipes to damage or collapse due to settlement of the waste. HDPE also is less susceptible to damage resulting from loss of plasticizers over time (i.e., aging), which can cause PVC pipe to become brittle.

- Placement of the well casings in 30 or 36-inch diameter boreholes, which provide additional separation between the waste and the well casings, thereby reducing the potential for differential stresses being placed on the well casings.

4.1.13 <u>Resistance to Decomposition Heat</u>

The components incorporated into the GCCS have a track record of good performance when subjected to the heat of decomposition under normal operating conditions. Typically, the components used in a modern GCCS are resistive to temperatures not exceeding 150 degrees Fahrenheit (^{o}F). The GCCS components most susceptible to heat damage are the well casings and any lateral or header piping systems installed within the waste mass. HDPE and PVC pipe have proven successful for numerous GCCS applications across the United States.

4.2 COMPLIANCE WITH §60.759(a)(2) - DENSITY OF GAS COLLECTION DEVICES

As described in Section 2, the wells and collectors were designed and located to provide coverage with appropriate zones of influence. The existing and proposed GCCS is intended to provide sufficient collection coverage to meet the NSPS surface emissions monitoring requirements. The adequacy of the well density will be confirmed during future surface emissions monitoring, including identifying any areas which require additional control measures, based upon monitoring results. The density of gas collection devices will be verified during surface emissions monitoring.

4.3 COMPLIANCE WITH §60.759(a)(3) - COLLECTION DEVICES PLACEMENT

The placement of gas collection devices proposed herein are designed to control all gas producing areas, except portions of Phases I and II that were used for disposal of non-degradable C&D waste. Compliance with §60.759(A)(3) will be evaluated based on surface emissions monitoring.

4.4 COMPLIANCE WITH §60.759(b)(1), (2), AND (3) - CONSTRUCTION OF SYSTEM COMPONENTS

As described in previous sections of this Plan, the GCCS components will be constructed of materials suitable for LFG applications.

4.5 COMPLIANCE WITH §60.759(c)(1) AND (2) - LANDFILL GAS CONVEYANCE

As described in Section 2.7 above, the existing GCCS blower/flare stations currently are designed to handle approximately 2,800 from Phases I and II and 1,500 scfm of LFG in Phase III. In addition, approximately 2,400 to 2,600 scfm of LFG is being transmitted to Cone Mills in the 16-inch LFG transmission pipeline. This flow rate capacity is expected to be adequate through the maximum LFG generation rates of the Landfill phases, based on current and projected waste filling rates. If the LFG recovery rate is projected to exceed this flow rate, changes to the blower/flare station, such as adding blowers or an additional flare, will be implemented.

The proposed GCCS components are consistent with current "state of the practice" designs. If design modifications are required to accommodate collection of LFG generated by future waste disposal and subsequent expansions of the GCCS coverage area, proposed modifications will be documented within the NSPS Semiannual Compliance Reports prepared for the site.

4.6 PLAN FOR SURFACE EMISSIONS MONITORING

Plans showing the proposed routes of surface emissions monitoring are presented in Figures 4-1, 4-2, 4-3, and 4-4. The surface emissions monitoring will be performed in accordance with the requirements set forth in the NSPS. The first monitoring event will take place during the quarter in which the system becomes subject to the operational requirements of the NSPS, with subsequent monitoring events scheduled in accordance with the NSPS.

Future surface emissions monitoring associated with expansion of the GCCS to future landfill phases will be scheduled to coincide with installation and startup of the GCCS per the NSPS startup dates for the respective phases, in accordance with the NSPS scheduling requirements.

4.7 RECORDKEEPING

No variances to the recordkeeping requirements set forth in §60.757(f) and (g) are proposed in this Plan. Recordkeeping shall be performed as set forth in the regulations.

SECTION 5

REQUESTED ALTERNATIVE MONITORING/RECORDKEEPING/ RECORDING PROCEDURES

Per 40 CFR 60.752(b)(2)(i)(B), the design plan shall include proposed alternatives to the prescriptive monitoring, record keeping and reporting requirements outlined in the NSPS. This section addresses exemptions/alternatives proposed for the Landfill.

5.1 ALTERNATIVE PROCEDURES TO SPECIFIC REQUIREMENTS

Section 60.753(b): *"Operate the collection system with negative pressure at each wellhead except under the following conditions:*

1. *A fire or increased well temperature.*
2. *Use of a geomembrane liner or synthetic cover. The owner or operator shall develop acceptable limits in the design plan.*
3. *A decommissioned well.*

The Landfill requests an acceptable pressure limit of 5 inches of water column for wells in areas that have a geomembrane cover.

Section CFR 60.753(c): *"Operate each interior wellhead in the collection system with either a nitrogen level less than twenty percent or an oxygen level less than five percent. The owner or operator may establish a higher...nitrogen or oxygen value at a particular well. A higher operating value demonstration shall show supporting data that the elevated parameter does not cause fires or significantly inhibit anaerobic decomposition by killing methanogens."*

The existing gas extraction system in Phase III has connections to leachate cleanout risers in order to extract gas from the leachate collection system for odor/surface emission control. Future expansions to the gas collection system may also utilize leachate sumps and cleanout risers as a method of interim control.

A review of the monitoring data from other landfills shows that leachate risers sometimes contain concentrations of nitrogen and oxygen similar to that of ambient air, above the NSPS thresholds. This is due to the fact that the leachate collection system is not an airtight vacuum system, and was not designed as such. However, it does provide a valuable collection point for landfill gas.

Unlike the vertical gas extraction wells, the leachate sump draws from the leachate collection system beneath the refuse. Therefore, concentrations of air within these extraction points will not cause subsurface oxidation within the refuse, as could potentially happen in a classic vertical extraction well within refuse. Therefore, the pressure, temperature and nitrogen/oxygen exceedance limits do not apply to the leachate cleanout riser and leachate sump extraction points. Other states have agreed with this interpretation and have granted exemptions for leachate sumps/cleanout risers from NSPS monitoring. Therefore, the Landfill proposes to exempt these devices from NSPS monitoring and operational requirements.

Section 60.753(c)(2) Operational Standards for Collection and Control Systems: *"...oxygen shall be determined by an oxygen meter using Method 3A..."*

When applicable, the Landfill is proposing to use an on-site multi-gas analyzer, in lieu of a laboratory method, for determining the oxygen content of the landfill gas at each well and monitoring point. The site will be using a portable meter, such as a GEM-500, GEM-2000, or equivalent, calibrated to the manufacturer's specifications, to determine the oxygen content of the gas. This is acceptable to and has previously been approved by U.S. EPA.

Section 60.753(d) Operational Standards for Collection and Control Systems: *"...A surface monitoring design plan shall be developed...Areas with steep slopes or other dangerous areas may be excluded from surface testing.*

The Landfill is proposing to exclude dangerous areas such as roads, the active area, truck traffic areas, and slopes steeper than or equal to 4:1 from surface emissions monitoring requirements. In addition, the facility is requesting that areas with ongoing construction or reconstruction of the gas collection system be temporarily excluded from the surface scans, until such time as the collection system is completed and/or functional.

In addition, the Landfill is proposing to widen the spacing between surface scan intervals from 30 meters to 60 meters in areas that have had final cover placed, where the final cover consists of a geomembrane liner. The geomembrane liner is expected to provide an excellent barrier to surface emissions.

The Landfill proposes to demonstrate this to the Agency by conducting surface scans initially using 30-meter spacing. Upon demonstration that the geomembrane-covered areas experience no exceedances for three consecutive quarters, the Landfill will petition to widen the spacing to 60 meters in these areas.

Section 60.755(a)(3): *"For the purpose of demonstrating whether the gas collection system flow rate is sufficient to determine compliance with 60.752(b)(2)(ii)(A)(3), the owner or operator shall measure gauge pressure in the gas collection header at each individual well, monthly."; and*

Section 60.755(a)(5): *"For the purpose of identifying whether excess air infiltration into the landfill is occurring, the owner or operator shall monitor each well monthly for temperature and nitrogen or oxygen as provided in 60.753(c)."; and*

Section 60.756: *"Except as provided in 60.752(b)(2)(i)(B),*
(a) Each owner or operator seeking to comply with 60.752(b)(2)(ii)(A) for an active gas

collection system shall install a sampling port and a thermometer or other temperature measuring device at each wellhead and:

(1) Measure the gauge pressure in the gas collection header on a monthly basis as provided in 60.755(a)(3); and
(2) Monitor nitrogen or oxygen concentration in the landfill gas on a monthly basis as provided in 60.755(a)(5); and
(3) Monitor temperature of the landfill gas on a monthly basis as provided in 60.755(a)(5)."

New vertical gas extraction wells are often placed in the active area of the landfill several years before the waste has reached final grades. This is in compliance with the NSPS. However, since the wells are placed in active areas, they periodically need to be "raised" (i.e. the well casing extended 15 to 25 vertically) in order to not be buried under lifts of trash. When they are raised, the HDPE lateral line which provides the applied vacuum is temporarily disconnected until the surrounding lift of trash is brought high enough to reconnect the well. The time frame between when a well is disconnected and raised, and when the waste height is high enough to reconnect the lateral, can often range from a few weeks to a few months. This can result in missed monthly readings at the well, since the well casing is too high for the technician to safely reach.

Since the NSPS allows for exclusion of surface monitoring in "dangerous areas" of the site, the Landfill believes it is reasonable to request exclusion to monitoring the wells raised in active areas. The facility proposes that readings will be missed at a particular well as long as the well cannot be safely accessed. If the facility cannot bring the waste height up to the new grade and re-attach the well within a reasonable amount of time, then modifications to the lateral/wellhead such as the well will be cut back down and re-attached will be made for monitoring. This request is in accordance with Section 60.752(b)(2)(i)(B), which allows the facility to propose alternatives to the monitoring procedures in the NSPS.

Section 60.755(c)(3) Compliance Provisions: *"Surface monitoring shall be performed...the probe inlet shall be placed within 5 to 10 centimeters of the ground."*

The Landfill is proposing to place the probe inlet as close as possible to 5 to 10 centimeters from the ground surface to the top of the vegetation. With a flame ionization detector (FID), any debris, grass or dirt will plug the tip causing the flame to go out. Once the flame is out the entire calibration procedure must be repeated prior to resuming sampling. By allowing flexibility in the probe placement, time-consuming flame out procedures can be avoided.

5.2 OTHER ALTERNATIVE PROCEDURES

Alternative Operating/Monitoring and Record Keeping for Non-Producing Wells

The intent of the NSPS is to reduce surface emissions of LFG. As such, the NSPS requires that a vacuum, and an oxygen content of less than 5 percent by volume, be maintained at all LFG extraction wells while the GCCS is in operation. However, in some situations, the quality of the LFG extracted, while under a constant vacuum, can be detrimentally affected by certain site-specific conditions. The most common cause would be a well or wells placed in an area of the landfill containing significantly older waste materials or installed in an area containing large quantities of inert wastes, both of which could result in partial anaerobic, partial aerobic conditions. Despite continued efforts to minimize the air intrusion by reducing the applied vacuum at non-producing wells, the extracted LFG can continue to exhibit poor gas composition.

As such, the Landfill is proposing an alternative operating and monitoring plan for those LFG extraction wells that are unable to obtain the NSPS performance requirements due to poor gas production or composition. The proposed alternative plan would classify active gas extraction wells that exhibit the following characteristics to be identified as non-producing wells:

- Gas extraction wells with three consecutive months of NSPS monitoring history when oxygen concentrations have remained above 5 percent by volume, and the presence of the elevated oxygen cannot be attributed to a specific event or operation of the system, and

- Methane surface emissions near the well(s) are below the NSPS compliance standard of less than 500 parts per million (ppm) above background.

The following alternative monitoring plan will be implemented for those wells that have been identified as non-producing per the above criteria.

- Non-producing gas extraction wells will be temporarily shut off.

- Non-producing gas extraction wells will continue to be monitored as part of the regular monthly monitoring regime, unless a formal submittal is approved by the NCDENR for the wells to be abandoned. However, non-producing wells will not be operated in accordance with the operations standards specified in 40 CFR §60.753.

- Should static LFG concentrations at the well increase to those levels considered typical for anaerobic conditions, the wellhead control valve will be opened and the well will be operated in accordance with the operational standards specified in 40 CFR §60.753. If the well(s) return to the non-producing characteristics, the well(s) will again be shut off and deemed exempt from NSPS operations requirements.

- If methane surface emissions are measured above 500 ppm above background around the non-producing well, the Landfill will conduct an evaluation of the area and implement corrective measures as required by 40 CFR §60.755(4), including the reactivation of the shut-off LFG extraction wells.

The Landfill is not seeking NCDENR approval to decommission or abandon such wells. Instead, it is being proposed that such wells be placed on the alternative operating and monitoring plan and temporarily be removed from further NSPS operation and monitoring requirements.

Start-Up of New Wells And Collection System

40 CFR 60.755(a)(4) does not require the landfill to expand the wellfield due to positive pressure within the first 180 days of system operation. During the first 180 days of collection and control system operations, where either nitrogen or oxygen and/or temperature exceedances are monitored, the Landfill proposes to apply corrective measures to achieve the operating standards; however no expansion of the collection system to address the exceedances will occur within 120 days. In addition, for new individual wells installed at the Landfill, the facility proposes to not expand the wellfield during the first 180 days of operation for any individual well which pressure, temperature and/ or either oxygen or nitrogen exceedances are monitored.

Use of an alternative sampling method

The Landfill proposes to use USEPA Method 3C or ASTM D3588 in place of Method 18 and ASTM D1946 to determine landfill gas components for calculating net heating value under 60.18(c)(3). 40 CFR 60.18 requires the use of Method 18 however USEPA's Office of Air Quality Planning and Standards regularly authorizes the use of Method 3C or ASTM D3588.

Per 40 CFR 60.752(b)(2)(i)(B), the design plan shall include proposed alternatives to the prescriptive monitoring, record keeping, and reporting requirements outlined in the NSPS. This section addresses exemptions/alternatives proposed in this submittal.

Wellfield Expansion

The drawings included with this submittal show the conceptual design of the GCCS based on current waste filling plans. As filling progresses, and as dictated by the final design of the various GCCS phases in the future, the locations of the vertical extraction wells, header, laterals, and condensate traps/sumps may vary from the locations shown on the attached drawings. While vertical wells and horizontal collectors may be substituted for each other, subsequent LFG designs will result in similar overall wellfield coverage.

Alternative Surface Emissions Remedial Actions

Section 60.755(c)(4)(v) of the NSPS requires that for any location where monitored methane concentrations exceed 500 parts per million by volume (ppmv) above background three times in a quarter, a new well or collector shall be installed within 120 days of the initial exceedance. An alternative to installing additional wells or collectors, such as upgrading the blower, header pipes, or control device must be approved by the Administrator for approval.

While alternatives are permitted if approved by the Administrator, the City recognizes that requesting and receiving approval within 120 days may not always be possible, depending on the review schedule of NCDENR or U.S. EPA. Therefore, in order to streamline implementation of alternative remedial actions that may be appropriate for correcting surface emissions monitoring exceedances, and minimizing fugitive LFG emissions, the City proposes that the following remedial actions be accepted as alternatives to installing additional wells:

- Installation of shallow subsurface LFG collectors immediately adjacent to the well or collectors closest to the surface emissions exceedance. The shallow collectors would be installed with valves and monitoring ports to control LFG extraction and provide monitoring data, similar to a standard LFG extraction wellhead. Each shallow collector will be assigned a unique identification number and be included in future monthly monitoring events. Record documentation for the installation and location of the collectors will be included in future semiannual NSPS reports. If future monitoring shows that the shallow collectors are no longer needed, they will be abandoned in place by shutting off the valve, or capping the collector.

- Installation of leachate dewatering pumps in wells of which a significant portion of the slotted well pipe is submerged in liquid. Dewatering of wells often increases LFG extraction rates, which can both improve the quality of the LFG extracted from a particular well and reduce the likelihood of surface emissions.

- Upgrades to the blower system. This may include installing larger blowers, additional units, improvements to the blower station piping system, including valves, etc., or upgrades to the condensate knockout system at the blower station. A description of the improvements will be included in either the future SEM reports or the semiannual NSPS report following the remediation.

- Troubleshooting and upgrades or repairs to header and lateral pipes, condensate sumps, or header isolation valves, which may be the cause of decreased vacuum or gas collection capacity in the vicinity of the exceedance. A description of the improvements will be included in either the future SEM reports or the semiannual NSPS report following the remediation.

APPENDIX A

GCCS DESIGN PLAN DRAWINGS

APPENDIX B

LANDFILL GAS GENERATION ESTIMATE CALCULATIONS

TABLE B-1. PROJECTED LFG AND NMOC GENERATION RATES
Phase I, White Street Landfill - Greensboro, North Carolina

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	Methane Generation Rates (m^3/yr)	LFG Generation Rates (cfm)	LFG Generation Rates (Million ft^3/yr)	NMOC Generation Rates (tons/yr)	NMOC Generation Rates (Mg/yr)
1965	186,275	0	168,986	0	0.000E+00	0	0	0	0.0
1966	192,795	186,275	174,901	168,986	1.436E+06	193	101	1	1.1
1967	199,542	379,070	181,021	343,887	2.853E+06	383	202	2	2.2
1968	206,526	578,612	187,357	524,908	4.253E+06	571	300	4	3.2
1969	213,755	785,138	193,915	712,265	5.638E+06	758	398	5	4.3
1970	221,236	998,893	200,702	906,180	7.011E+06	942	495	6	5.3
1971	228,980	1,220,129	207,727	1,106,882	8.375E+06	1,125	592	7	6.3
1972	236,994	1,449,109	214,997	1,314,610	9.732E+06	1,308	687	8	7.3
1973	245,289	1,686,103	222,522	1,529,607	1.109E+07	1,490	783	9	8.4
1974	253,874	1,931,392	230,311	1,752,129	1.244E+07	1,671	878	10	9.4
1975	262,759	2,185,266	238,371	1,982,440	1.379E+07	1,853	974	11	10.4
1976	281,956	2,448,025	255,786	2,220,811	1.514E+07	2,035	1,069	13	11.4
1977	281,474	2,729,981	255,349	2,476,597	1.658E+07	2,228	1,171	14	12.5
1978	0	3,011,455	0	2,731,946	1.794E+07	2,411	1,267	15	13.5
1979	0	3,011,455	0	2,731,946	1.706E+07	2,293	1,205	14	12.9
1980	0	3,011,455	0	2,731,946	1.623E+07	2,181	1,146	13	12.2
1981	0	3,011,455	0	2,731,946	1.544E+07	2,075	1,091	13	11.6
1982	0	3,011,455	0	2,731,946	1.469E+07	1,974	1,037	12	11.1
1983	0	3,011,455	0	2,731,946	1.397E+07	1,877	987	12	10.5
1984	0	3,011,455	0	2,731,946	1.329E+07	1,786	939	11	10.0
1985	0	3,011,455	0	2,731,946	1.264E+07	1,699	893	11	9.5
1986	0	3,011,455	0	2,731,946	1.202E+07	1,616	849	10	9.1
1987	0	3,011,455	0	2,731,946	1.144E+07	1,537	808	10	8.6
1988	0	3,011,455	0	2,731,946	1.088E+07	1,462	768	9	8.2
1989	0	3,011,455	0	2,731,946	1.035E+07	1,391	731	9	7.8
1990	0	3,011,455	0	2,731,946	9.845E+06	1,323	695	8	7.4
1991	0	3,011,455	0	2,731,946	9.365E+06	1,258	661	8	7.1
1992	0	3,011,455	0	2,731,946	8.908E+06	1,197	629	7	6.7
1993	0	3,011,455	0	2,731,946	8.474E+06	1,139	598	7	6.4
1994	0	3,011,455	0	2,731,946	8.060E+06	1,083	569	7	6.1
1995	0	3,011,455	0	2,731,946	7.667E+06	1,030	542	6	5.8
1996	0	3,011,455	0	2,731,946	7.293E+06	980	515	6	5.5
1997	0	3,011,455	0	2,731,946	6.938E+06	932	490	6	5.2
1998	0	3,011,455	0	2,731,946	6.599E+06	887	466	5	5.0
1999	0	3,011,455	0	2,731,946	6.277E+06	844	443	5	4.7
2000	0	3,011,455	0	2,731,946	5.971E+06	802	422	5	4.5
2001	0	3,011,455	0	2,731,946	5.680E+06	763	401	5	4.3
2002	0	3,011,455	0	2,731,946	5.403E+06	726	382	4	4.1
2003	0	3,011,455	0	2,731,946	5.139E+06	691	363	4	3.9
2004	0	3,011,455	0	2,731,946	4.889E+06	657	345	4	3.7
2005	0	3,011,455	0	2,731,946	4.650E+06	625	328	4	3.5
2006	0	3,011,455	0	2,731,946	4.424E+06	594	312	4	3.3
2007	0	3,011,455	0	2,731,946	4.208E+06	565	297	3	3.2
2008	0	3,011,455	0	2,731,946	4.003E+06	538	283	3	3.0
2009	0	3,011,455	0	2,731,946	3.807E+06	512	269	3	2.9
2010	0	3,011,455	0	2,731,946	3.622E+06	487	256	3	2.7
2011	0	3,011,455	0	2,731,946	3.445E+06	463	243	3	2.6
2012	0	3,011,455	0	2,731,946	3.277E+06	440	231	3	2.5
2013	0	3,011,455	0	2,731,946	3.117E+06	419	220	3	2.4
2014	0	3,011,455	0	2,731,946	2.965E+06	398	209	2	2.2
2015	0	3,011,455	0	2,731,946	2.821E+06	379	199	2	2.1
2016	0	3,011,455	0	2,731,946	2.683E+06	361	190	2	2.0
2017	0	3,011,455	0	2,731,946	2.552E+06	343	180	2	1.9
2018	0	3,011,455	0	2,731,946	2.428E+06	326	171	2	1.8
2019	0	3,011,455	0	2,731,946	2.309E+06	310	163	2	1.7
2020	0	3,011,455	0	2,731,946	2.197E+06	295	155	2	1.7

ESTIMATED NMOC CONCENTRATION IN LFG:	107	ppmv
ASSUMED METHANE CONTENT OF LFG:	50%	
SELECTED DECAY RATE CONSTANT:	0.05	
SELECTED ULTIMATE METHANE RECOVERY RATE	5,446	ft3/ton
METRIC EQUIVALENT:	170	cu m/Mg

TABLE B-2. PROJECTED LFG AND NMOC GENERATION RATES
Phase II, White Street Landfill - Greensboro, North Carolina

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	Methane Generation Rates (m^3/yr)	LFG Generation Rates (cfm)	LFG Generation Rates (Million ft^3/yr)	NMOC Generation Rates (tons/yr)	NMOC Generation Rates (Mg/yr)
1978	240,000	0	217,724	0	0.000E+00	0	0	0	0.0
1979	240,000	240,000	217,724	217,724	1.851E+06	249	131	10	8.8
1980	240,000	480,000	217,724	435,449	3.611E+06	485	255	19	17.2
1981	240,000	720,000	217,724	653,173	5.286E+06	710	373	28	25.2
1982	240,000	960,000	217,724	870,897	6.878E+06	924	486	36	32.7
1983	240,000	1,200,000	217,724	1,088,622	8.394E+06	1,128	593	44	39.9
1984	240,000	1,440,000	217,724	1,306,346	9.835E+06	1,322	695	52	46.8
1985	239,000	1,680,000	216,817	1,524,070	1.121E+07	1,506	791	59	53.3
1986	262,000	1,919,000	237,682	1,740,888	1.250E+07	1,680	883	66	59.5
1987	292,000	2,181,000	264,898	1,978,570	1.391E+07	1,870	983	73	66.2
1988	344,000	2,473,000	312,072	2,243,468	1.549E+07	2,081	1,094	81	73.7
1989	342,000	2,817,000	310,257	2,555,539	1.738E+07	2,336	1,228	91	82.7
1990	340,000	3,159,000	308,443	2,865,797	1.917E+07	2,576	1,354	101	91.2
1991	331,000	3,499,000	300,278	3,174,239	2.086E+07	2,803	1,473	109	99.3
1992	292,000	3,830,000	264,898	3,474,518	2.239E+07	3,009	1,582	117	106.6
1993	236,292	4,122,000	214,360	3,739,416	2.355E+07	3,165	1,664	124	112.1
1994	240,746	4,358,292	218,401	3,953,776	2.423E+07	3,256	1,711	127	115.3
1995	257,407	4,599,038	233,516	4,172,177	2.490E+07	3,346	1,759	131	118.5
1996	290,370	4,856,445	263,419	4,405,693	2.567E+07	3,450	1,813	135	122.2
1997	268,815	5,146,815	243,865	4,669,112	2.666E+07	3,582	1,883	140	126.9
1998	0	5,415,630	0	4,912,977	2.743E+07	3,686	1,938	144	130.5
1999	0	5,415,630	0	4,912,977	2.609E+07	3,507	1,843	137	124.2
2000	0	5,415,630	0	4,912,977	2.482E+07	3,336	1,753	130	118.1
2001	0	5,415,630	0	4,912,977	2.361E+07	3,173	1,668	124	112.3
2002	0	5,415,630	0	4,912,977	2.246E+07	3,018	1,586	118	106.9
2003	0	5,415,630	0	4,912,977	2.136E+07	2,871	1,509	112	101.7
2004	0	5,415,630	0	4,912,977	2.032E+07	2,731	1,435	107	96.7
2005	0	5,415,630	0	4,912,977	1.933E+07	2,598	1,365	101	92.0
2006	0	5,415,630	0	4,912,977	1.839E+07	2,471	1,299	96	87.5
2007	0	5,415,630	0	4,912,977	1.749E+07	2,350	1,235	92	83.2
2008	0	5,415,630	0	4,912,977	1.664E+07	2,236	1,175	87	79.2
2009	0	5,415,630	0	4,912,977	1.583E+07	2,127	1,118	83	75.3
2010	0	5,415,630	0	4,912,977	1.506E+07	2,023	1,063	79	71.6
2011	0	5,415,630	0	4,912,977	1.432E+07	1,924	1,011	75	68.1
2012	0	5,415,630	0	4,912,977	1.362E+07	1,831	962	71	64.8
2013	0	5,415,630	0	4,912,977	1.296E+07	1,741	915	68	61.7
2014	0	5,415,630	0	4,912,977	1.233E+07	1,656	871	65	58.7
2015	0	5,415,630	0	4,912,977	1.172E+07	1,576	828	61	55.8
2016	0	5,415,630	0	4,912,977	1.115E+07	1,499	788	58	53.1
2017	0	5,415,630	0	4,912,977	1.061E+07	1,426	749	56	50.5
2018	0	5,415,630	0	4,912,977	1.009E+07	1,356	713	53	48.0
2019	0	5,415,630	0	4,912,977	9.600E+06	1,290	678	50	45.7
2020	0	5,415,630	0	4,912,977	9.131E+06	1,227	645	48	43.4

ESTIMATED NMOC CONCENTRATION IN LFG:	675	ppmv
ASSUMED METHANE CONTENT OF LFG:	50%	
SELECTED DECAY RATE CONSTANT:	0.05	
SELECTED ULTIMATE METHANE RECOVERY RATE	5,446	ft3/ton
METRIC EQUIVALENT:	170	cu m/Mg

TABLE B-3. PROJECTED LFG AND NMOC GENERATION RATES
Phase III White Street Landfill - Greensboro, North Carolina

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	Methane Generation Rates (m^3/yr)	LFG Generation Rates (cfm)	LFG Generation Rates (Million ft^3/yr)	NMOC Generation Rates (tons/yr)	NMOC Generation Rates (Mg/yr)
1997	8,608	0	7,809	0	0.000E+00	0	0	0.0	0.0
1998	255,306	8,608	231,610	7,809	6.638E+04	9	5	0.5	0.5
1999	262,512	263,914	238,147	239,419	2.032E+06	273	144	16.1	14.6
2000	271,562	526,426	246,357	477,566	3.957E+06	532	279	31.3	28.4
2001	266,636	797,988	241,888	723,923	5.858E+06	787	414	46.3	42.0
2002	260,109	1,064,624	235,967	965,811	7.628E+06	1,025	539	60.3	54.7
2003	195,595	1,324,733	177,441	1,201,778	9.262E+06	1,245	654	73.3	66.5
2004	128,336	1,520,328	116,424	1,379,218	1.032E+07	1,387	729	81.6	74.0
2005	134,753	1,648,664	122,246	1,495,643	1.080E+07	1,452	763	85.5	77.5
2006	141,490	1,783,417	128,358	1,617,889	1.132E+07	1,521	799	89.5	81.2
2007	148,565	1,924,907	134,776	1,746,246	1.186E+07	1,593	837	93.8	85.1
2008	0	2,073,472	0	1,881,022	1.242E+07	1,669	877	98.3	89.2
2009	0	2,073,472	0	1,881,022	1.182E+07	1,588	835	93.5	84.8
2010	0	2,073,472	0	1,881,022	1.124E+07	1,511	794	88.9	80.7
2011	0	2,073,472	0	1,881,022	1.069E+07	1,437	755	84.6	76.7
2012	0	2,073,472	0	1,881,022	1.017E+07	1,367	718	80.5	73.0
2013	0	2,073,472	0	1,881,022	9.675E+06	1,300	683	76.5	69.4
2014	0	2,073,472	0	1,881,022	9.204E+06	1,237	650	72.8	66.0
2015	0	2,073,472	0	1,881,022	8.755E+06	1,176	618	69.3	62.8
2016	0	2,073,472	0	1,881,022	8.328E+06	1,119	588	65.9	59.8
2017	0	2,073,472	0	1,881,022	7.922E+06	1,064	559	62.7	56.8
2018	0	2,073,472	0	1,881,022	7.535E+06	1,013	532	59.6	54.1
2019	0	2,073,472	0	1,881,022	7.168E+06	963	506	56.7	51.4
2020	0	2,073,472	0	1,881,022	6.818E+06	916	482	53.9	48.9

ESTIMATED NMOC CONCENTRATION IN LFG:	1018	ppmv
ASSUMED METHANE CONTENT OF LFG:	50%	
SELECTED DECAY RATE CONSTANT:	0.05	
SELECTED ULTIMATE METHANE RECOVERY RATE	5,446	ft3/ton
METRIC EQUIVALENT:	170	cu m/Mg